

7. The United States produces about 380,000 metric tons of aluminum per month. If the density of aluminum is 2.7 g/cm^3 , how many cubic centimeters of aluminum does this represent?

(1 metric ton = 2200 lbs)

8. The density of lead is $11. \text{ g/cm}^3$, and you have a 50.0lb rectangular sheet of the metal. Two sides are measured to be 3.0cm and 4.0cm. What is the length, in feet, of the sheet?

More Challenging Factor Label Problems

1. You and two friends decide to go to Mexico City from El Paso, TX where y'all live. You volunteer your car if everyone chips in for gas. Someone asks how much the gas will cost per person on a round trip. Your first step is to call your smarter brother to see if he'll figure it out for you. Naturally he's too busy to bother, but he does tell you that it is 2015 km to Mexico City, there's 11 cents to the peso, and gas costs 5.8 pesos per liter in Mexico. You know your car gets 21 miles to the gallon, but we still don't have a clue as to how much the trip is going to cost each person in dollars. (1mi = 1.6 km)

Given: 2015 km (one way) Need: \$/person
3 people

$$\begin{aligned} 11\text{¢} &= 1 \text{ peso} = \$0.11 \text{ (either is OK)} \\ 5.8 \text{ pesos} &= 1 \text{ L} \\ 21 \text{ mi} &= 1 \text{ gal} \\ 4 \text{ qt} &= 1 \text{ gal} \\ 1.1 \text{ qt} &= 1 \text{ L} \\ 1 \text{ mi} &= 1.6 \text{ km} \end{aligned}$$

$$\underbrace{2015 \text{ km} \times 2}_{\text{round trip}} \left(\frac{1 \text{ mi}}{1.6 \text{ km}} \right) \left(\frac{1 \text{ gal}}{21 \text{ mi}} \right) \left(\frac{4 \text{ qt}}{1 \text{ gal}} \right) \left(\frac{1 \text{ L}}{1.1 \text{ qt}} \right) \left(\frac{5.8 \text{ pesos}}{1 \text{ L}} \right) \left(\frac{\$0.11}{1 \text{ peso}} \right) \left(\frac{1}{3 \text{ people}} \right) = \boxed{\$92.75}$$

2. An average man requires about 200mg of riboflavin (vitamin B2) per day. How many tablespoons of cheese would a man have to eat each day if this was the only source of riboflavin and if mozzarella cheese contained 5.5 mg. of riboflavin per gram? The density of mozzarella cheese is 68.93 grams per dL. (1TBS = 15mL) *rf (riboflavin)*

Given: 200mg rf

5.5mg rf = 1g cheese

$D_{\text{cheese}} = 68.93 \text{ g/dL}$

Need: TBS of cheese

1TBS = 15mL

100mL = 1dL

$$V = \frac{200 \text{mg rf} \left(\frac{1 \text{g cheese}}{5.5 \text{mg rf}} \right) \left(\frac{1 \text{dL}}{68.93 \text{g}} \right) \left(\frac{100 \text{mL}}{1 \text{dL}} \right) \left(\frac{1 \text{TBS}}{15 \text{mL}} \right)}{\text{density in g/TBS}} = 4 \text{TBS}$$

$D = \frac{M}{V}$
 $V = \frac{M}{D}$

3. If 1.0g of silver can be converted into 400.0 square feet of mirrors, how thick is the coating in millimeters. The density of silver is 105 dg/cm³.

Given: 1.0g silver = m

105 g/cm³ = D

400.0 ft² = A

Need: thickness in mm

1g = 10dg

1 in = 2.54cm

12 in = 1ft

10mm = 1cm

$$D = \frac{M}{V}$$

$$V = \frac{M}{D}$$

$$\frac{V}{\text{Area}} = \text{Thickness}$$

$$1.0 \text{g} \left(\frac{\text{cm}^3}{105 \text{dg}} \right) \left(\frac{10 \text{dg}}{1 \text{g}} \right) \left(\frac{1 \text{in}}{2.54 \text{cm}} \right)^3 \left(\frac{1 \text{ft}}{12 \text{in}} \right)^3 \left(\frac{1}{400.0 \text{ft}^2} \right) \left(\frac{12 \text{in}}{1 \text{ft}} \right) \left(\frac{2.54 \text{cm}}{1 \text{in}} \right) \left(\frac{10 \text{mm}}{1 \text{cm}} \right) = 2.6 \times 10^{-6} \text{mm}$$

mass density g/ft³ area

4. The diameter of metal wire is often referred to by its American wire gauge number. A 20-gauge wire has a diameter of 0.03196 inches. How many meters of wire are present in a 3.0 pound spool of 20-gauge copper wire? The density of copper is 8.92 g per mL. (volume of a cylinder = $\pi r^2 l$ where l=length)

Given: 3.0lb = m

8.92 g/mL = D

0.03196 in = diameter

Need: Length of wire

$$V_{\text{cylinder}} = \pi r^2 l$$

$$r = \frac{d}{2}$$

$$D = \frac{M}{V}$$

$$l = \frac{V}{\pi r^2}$$

$$l = \frac{V}{\pi r^2}$$

$$V = \frac{M}{D}$$

$$3.0 \text{lb} \left(\frac{454 \text{g}}{1 \text{lb}} \right) \left(\frac{1 \text{mL}}{8.92 \text{g}} \right) \left(\frac{1 \text{cm}^3}{1 \text{mL}} \right) \left(\frac{1 \text{in}}{2.54 \text{cm}} \right)^3 \left(\frac{4}{\pi (0.03196 \text{in})^2} \right) \left(\frac{2.54 \text{cm}}{1 \text{in}} \right) \left(\frac{1 \text{m}}{100 \text{cm}} \right) = 3.0 \times 10^2 \text{m}$$

5. It is known that 400.0 pounds of iron metal occupy a volume of 0.02234 cubic meters. Calculate the radius in meters of an iron sphere that has been determined to contain 54.5 kilograms of iron.

$$D = 400.0 \text{lb} / 0.02234 \text{m}^3$$

need r in meters

1 Kg = 2.2lb.

$$M = 54.5 \text{Kg}$$

$$D = \frac{M}{V} \quad V = \frac{M}{D}$$

$$V = \frac{4}{3} \pi r^3 \quad r = \sqrt[3]{\frac{3V}{4\pi}}$$

$$\sqrt[3]{54.5 \text{kg} \left(\frac{2.2 \text{lb}}{1 \text{kg}} \right) \left(\frac{0.02234 \text{m}^3}{400.0 \text{lb}} \right) \left(\frac{3}{4\pi} \right)} = 0.117 \text{m}$$